Ontario

MINISTRY OF THE ENVIRONMENT
Water Resources Branch
Hydrology & Monitoring Section

Hon. William G. Newman, *Minister*
Everett Biggs, *Deputy Minister*

MAP 3005-2

LOW-FLOW CHARACTERISTICS OF STREAMS IN SOUTHWESTERN ONTARIO

Scale 1:300,000

5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 Kilometres

EXPLANATION

▲ Continuous record gauging station
■ Periodic measurement gauging station

Note: Flows in cubic feet per second

More than Ten Years Data

Station number	**02GE003**	1,660	*Drainage area in sq. mi.*
Mean annual	1,540 R	56-71	*Period analyzed*
7 day Q_2	163	122	*95% duration*
7 day Q_{10}	98.0	103	*98% duration*
7 day Q_{20}	80.0	86.0	*99% duration*

R *Regulated* N *Non-regulated*

Five to Nine Years Data

Station number	**02GD018**	53	*Drainage area in sq. mi.*
Mean annual	66.8	65-71	*Period analyzed*
7 day Q_2	8.1	R	R *regulated or* N *non-regulated*
Minimum 7 day	2.8	1.4	*Minimum daily*

Less than Five Years Data

Station number	**02GC024**	10.5	*Drainage area in sq. mi.*
Mean annual	9.5	70-72	*Period analyzed*
R *regulated or* N *non-regulated*	N	3.2	*Minimum daily*

Periodic Measurements

67-72	*Period of observation*
N	R *regulated or* N *non-regulated*
2.9	*Minimum observed*

Compiled by J. D. Eddie, 1974
Cartography by V. Roberts, 1974

DESCRIPTIVE NOTES

Introduction

A knowledge of the magnitude and frequency of recurrence of low flows in streams and rivers is vital in the planning, management and protection of water resources. Low-flow information is needed for assessing water availability, allocating water takings and designing water-supply and waste-assimilation projects; thus it is used by government agencies, industries, municipalities and consulting engineers.

The purpose of this map is to describe the low-flow characteristics of streams and rivers in southwestern Ontario.

Analysis

Analyses have been made using data for the summer-fall period, June 1 to November 30. Low flows in this season are generally more critical than those of the winter due to greater recreational use of lakes and streams and increased productivity of aquatic biota. Low flows of the summer-fall season result from meteorological conditions that are different from those of the winter period and are regarded as a distinct statistical population requiring separate consideration.

For some stations with long records in basins subject to urbanization and flow regulation, the full period of record has not been analyzed. A period of record has been selected to exclude major regulation changes such as the start of operation of a reservoir or a recent period of record has been used to reflect the effects of urbanization. No attempt has been made to compensate for the effects of any regulation included in the period selected or to adjust all analyses to a common period.

In the preparation of this map, two main categories of stations have been recognized: stations with daily records published by Water Survey of Canada[1] and stations not having daily records at which periodic flow measurements have been made by the Ontario Ministry of the Environment[2]. The stations with daily records have been sub-divided as follows:

1. *Stations with ten or more years of record.*
2. *Stations with five to nine years of record.*
3. *Stations with less than five years of record.*

Two standard analyses were used to obtain the data presented; low-flow frequency analysis and flow-duration analysis. Use of a low-flow frequency or flow-duration curve for design purposes makes the implicit assumption that basin conditions, during the life of the structure for which the design flow is required, are essentially the same as those prevailing during the period of record used for analysis. It is also assumed that the record used is a representative sample of the streamflows at the site; this is most likely to be valid if a long record is utilized.

Low-Flow Frequency Analysis

A low-flow frequency curve is a graph of seasonal (or annual) minimum streamflow versus average probability level or recurrence interval (in years). The analysis is impractical with short records and has been made only for stations with ten or more years of data. It was made with the aid of a digital computer using 7-day mean flows. From the frequency curves obtained by plotting the results on extremal probability paper, commonly used design values were taken (7-day Q_2, 7-day Q_{10} and 7-day Q_{20} with extrapolation of the curves as required). The median value of the seasonal minimum 7-day flows was used as an estimate of the 7-day Q_2 for stations with five to nine years of record.

Flow-Duration Analysis

A flow-duration curve is a cumulative frequency curve which shows the percentage of time specified streamflows are equalled or exceeded during a given period of record. The curve shows the flow characteristics of the stream throughout its range of discharge without regard to the sequence of streamflow events. A continuous streamflow record of at least one season is necessary to make the analysis but the results are more representative of average conditions if a long record is used.

Explanation of Terms

Low flow	— The minimum stream discharge that occurs within a given time period.
Minimum 7-day flow	— The lowest mean discharge for 7 consecutive days during a given period.
7-day Q_2	— The 7-day low flow that occurs, on the average, once in 2 years or has a 50 per cent chance of occurring in any given year.
7-day Q_{10}	— The 7-day low flow that occurs, on the average, once in 10 years or has a 10 per cent chance of occurring in any given year.
7-day Q_{20}	— The 7-day low flow that occurs, on the average, once in 20 years or has a 5 per cent chance of occurring in any given year.
95% duration	— The daily flow that was equalled or exceeded 95% of the time during the period of record analyzed.
98% duration	— The daily flow that was equalled or exceeded 98% of the time during the period of record analyzed.
99% duration	— The daily flow that was equalled or exceeded 99% of the time during the period of record analyzed.
Mean Annual Discharge	— The arithmetic mean of all the individual annual mean discharges in the period of record analyzed.
Minimum Daily Discharge	— The lowest recorded value of all the individual daily mean discharges in the period of record analyzed.
Natural Flow	— The stream is free from major withdrawals and releases and the operation of large reservoirs; however, it may be subject to the effects of changing land-use practices, the operation of small recreational ponds and minor withdrawals and releases.
Regulated Flow	— The stream is subject to major diversions or withdrawals, effluent discharge, reservoir operation or other measures likely to alter significantly the values or distribution of mean daily flows.

References

1) Surface Water Data—Ontario, Department of the Environment, Water Survey of Canada, (Published annually).
2) Selected Streamflow Data for Ontario, Ontario Ministry of the Environment, (Published annually).

INDEX OF GAUGING STATIONS

Name	Station No.
Alder Creek near New Dundee	02GA030
Ardwell Creek near Highgate	Periodic
Ausable River near Springbank	02FF002
Ausable River near Crediton	Periodic
Avon River above Stratford	Periodic
Avon River below Stratford	02GD018
Batteaux River near Collingwood	Periodic
Bayfield River near Varna	02FF007
Bayfield River near Seaforth	Periodic
Bear Creek above Wilkesport	02GG004
Bear Creek near Petrolia	02GG006
Beatty Saugeen River near Hanover	Periodic
Beaver River above Eugenia Power House	02FB001
Beaver River near Clarksburg	02FB009
Beaver River near Kimberley	02FB003
Big Creek near Delhi	02GC006
Big Creek near Kelvin	02GC011
Big Creek near Tilbury	Periodic
Big Creek near Walsingham	02GC007
Big Otter Creek above Otterville	02GC017
Big Otter Creek at Tillsonburg	02GC010
Big Otter Creek near Vienna	02GC004
Bighead River near Meaford	02FB010
Blue Springs Creek near Eden Mills	02GA031
Boyle Drain near Atwood	02FE010
Canagagigue Creek near Elmira	02GA023
Canard River near River Canard	Periodic
Carrick Creek near Carlsruhe	02FC011
Catfish Creek near Sparta	02GC018
Cedar Creek near Arner	Periodic
Cedar Creek at Woodstock	02GD011
Clear Creek at Clear Creek	Periodic
Conestogo River at Drayton	02GA017
Conestogo River at Glen Allan	02GA028
Conestogo River near Conestogo	02GA013
Dedrich Creek near Port Rowan	02GC013
Dingman Creek near London	Periodic
Dingman Creek at Lambeth	02GE005
Dodd Creek at St. Thomas	Periodic
Dodd Creek at Talbotville Royal	Periodic
Eramosa River above Guelph	02GA029
Fairchild Creek near Brantford	02GB007
Fish Creek near Prospect Hill	02GD010
Fishers Creek near Fishers Glen	02GC023
Grand River at Galt	02GA003
Grand River at Brantford	02GB001
Grand River at Keldon	Periodic
Grand River Below Shand Dam	02GA016
Grand River at West Montrose	02GA034
Grand River at Marsville	02GA014
Hay Creek at Hwy. 24	Periodic
Hemlock Creek near Port Burwell	02GC025
Horner Creek near Mount Vernon	02GB008
Hickory Creek at Forest	Periodic
Jeannettes Creek Tributary near Merlin	Periodic
Kettle Creek at St. Thomas	02GC002
Kettle Creek at St. Thomas	Periodic
Kettle Creek above St. Thomas	Periodic
Laurel Creek at Waterloo	02GA024
Little Ausable River near Lucan	Periodic
Little Maitland River at Bluevale	02FE007
Little Otter Creek near Straffordville	02GC015
Lucknow River near Lucknow	Periodic
Lucknow River at Port Albert	Periodic
Lutteral Creek near Oustic	02GA033
Lynn River at Simcoe	02GC008
Lynn River at Port Dover	Periodic
Maitland River above Wingham	02FE005
Maitland River below Wingham	02FE002
Maitland River near Donnybrook	02FE004
McGregor Creek near Ridgetown	Periodic
Medway River at London	02GD008
Middle Maitland River near Listowel	02FE003
Middle Maitland River near Belgrave	02FE008
Middle Maitland River near Ethel	Periodic
Middle Thames River at Thamesford	02GD004
Mount Pleasant Creek near Burtch	02GB011
Nanticoke Creek at Nanticoke	02GC022
Newbiggen Creek near Glencoe	Periodic
Nith River at New Hamburg	02GA018
Nith River near Canning	02GA010
North Branch Creek at Embro	Periodic
North Creek at Delhi	02GC005
North Penetangore River at Kincardine	Periodic
North Saugeen River near Paisley	02FC013
North Thames River at London	02GD007
North Thames River at St. Mary's	02GD005
North Thames River below Fanshawe Dam	02GD003
North Thames River near Mitchell	02GD014
North Thames River above Mitchell	Periodic
North Thames River near Thorndale	02GD015
Orchard Creek near Meaford	Periodic
Parkhill Creek near Parkhill	02FF003
Patterson Creek near Simcoe	02GC012
Penetangore River near Kincardine	Periodic
Penetangore River Tributary near Kincardine	Periodic
Pike Creek near Windsor	Periodic
Pine River near Amberley	Periodic
Pottawatomi River at Owen Sound	Periodic
Pottersburg Creek near London Airport	Periodic
Pottersburg Creek at London	Periodic
Pretty River at Collingwood	Periodic
Puce River near Windsor	Periodic
Rocky Saugeen River near Markdale	Periodic
Rocky Saugeen River near Traverston	02FC004
Ruscom River near Ruscom Station	02GH002
Sauble River at Sauble Falls	02FA001
Sauble River near Allenford	Periodic
Saugeen River near Durham	02FC014
Saugeen River near Port Elgin	02FC001
Saugeen River near Walkerton	02FC002
Saugeen River near Priceville	Periodic
Silver Creek below Seaforth	Periodic
Silver Creek near Copenhagen	02GC024
South Maitland River at Summerhill	02FE009
South Otter Creek near Port Burwell	02GC016
South Parkhill Creek near Parkhill	02FF004
South Saugeen River near Hanover	02FC012
South Saugeen River near Mount Forest	Periodic
Speed River below Guelph	02GA015
Speed River above Guelph	02GA020
Sturgeon Creek near Leamington	02GH001
Sydenham River at Alvinston	02GG002
Sydenham River near Dresden	02GG007
Sydenham River at Strathroy	02GG005
Sydenham River Tributary below Strathroy	Periodic
Sydenham River near Owen Sound	02FB007
Talbot Creek near Iona	Periodic
Teeswater River near Riversdale	Periodic
Teeswater River near Paisley	02FC015
Telfer Creek at Leith	Periodic
Thames River at Byron	02GE002
Thames River at Ingersoll	02GD016
Thames River at Thamesville	02GE003
Thames River at Woodstock	02GD012
Thames River near Ealing	02GD001
Thames River near Tavistock	Periodic
Thames River at Innerkip	Periodic
Thames River Tributary at Bothwell	Periodic
Tilbury Creek near Tilbury	Periodic
Trout Creek near Fairview	02GD019
Trout Creek near St. Mary's	02GD009
Turkey Creek at Windsor	Periodic
Venison Creek near Walsingham	02GC021
Waubuno Creek near Dorchester	02GD020
Whirl Creek at Mitchell	Periodic
White Ash Creek near Thamesville	Periodic
Young Creek near Vittoria	02GC014